

one species also of Terns. They were neither of them common, and I did not succeed in obtaining specimens.

†59. *PODICIPES DOMINICUS.*

(Cory, op. cit. p. 185.)

In July, while shooting in the Yuna swamp, I several times obtained a good view of this little Grebe. It was very shy, and always dived or swam into the rushes on the first appearance of the boat.

XXVI.—*On some Fossil Remains of Carinate Birds from Central Madagascar.* By CHAS. W. ANDREWS, B.Sc., F.Z.S., Assistant in the British Museum (Natural History).

(Plates VIII. & IX.)

DURING his recent visit to Madagascar, Dr. Forsyth Major spent several months at Sirabé, in the centre of the island, a district well known for the abundance of fossil bones to be obtained there. A large number of excavations, most of them of considerable depth (12–15 ft.), were made, and a very fine collection of the remains of the extinct species of *Hippopotamus* and other mammals, of several species of *Æpyornis*, and also of numerous carinate birds was made. The present paper deals only with the last, which are mostly aquatic birds, though bones of a Rail and a Hawk also occur. By far the greater number of specimens were obtained from a depth of from twelve to fifteen feet in a marly layer, which Dr. Major believes to have been deposited on the bed of an old lake. Above this comes a layer of coarse gravelly character, consolidated with carbonate of lime and containing rolled and broken bones; this probably marks a volcanic outburst, accompanied by the breaking forth of numerous hot springs charged with carbonate of lime. Above this deposit there is another, about five or six feet in thickness, of black earth, in which also bird-bones occur, though comparatively rare.

In the marly layer the carinate remains are found in association with those of a rather small species of *Æpyornis*, the

Æ. hildebrandti of Burckhardt. In the black earth, on the other hand, this species does not occur, but remains of the somewhat larger *Æ. mulleri*, M.-Edw. & Grand., were found, as well as some well-preserved bones of the smaller and more slender Struthious bird, *Mullerornis agilis*, M.-Edw. & Grand. The difference between the species found in the deeper deposits and those in the more superficial black earth indicates that the former must be of considerable antiquity.

The most remarkable of the extinct types of Carinatae found by Dr. Major is a large Anserine bird (see Plate VIII.) which in those parts of the skeleton known presents many peculiar characters. The greater number of the specimens referred to this species were obtained from the marly layer, but the associated remains (here taken as the types) appear to have been found in the superficial deposit.

Remains of at least four or five individuals are included in the collection, and fortunately in one or two cases a number of bones are known to have belonged to the same skeleton. The best of these associated sets includes the right femur and tibio-tarsus, the proximal ends of the left coracoid and scapula and of the right metacarpus: these will be taken as the type specimens. Among the other more or less complete bones which can be referred with certainty to this species are an extremely well-preserved left tibia and femur, found in association, an imperfect metatarsus, and fragments of a sternum.

It may be stated at once that this bird is quite unlike any species now inhabiting Madagascar or, indeed, any other part of the world. Among fossil forms, as will be shown below, it resembles most nearly a large extinct Anserine bird, *Chenalopez pugil*, described by O. Winge* from remains found in the caverns of Lagoa Santa in Brazil. But even from that it differs so much in the form and proportions of its metatarsus that it is here regarded as representing a new genus, for which the name *Centronis* is proposed; the specific name adopted for this form being *C. majori*, after its dis-

* Winge, Oluf, "Fugle fra Knoglehuler i Brasilien," E Museo Lundii, Bd. i., Copenhagen, 1888.

coverer. Examination of the distal extremity of the *tibio-tarsus* (Pl. VIII. figs. 1 & 2) shows at once that we are dealing with an Anserine bird; the very deep channel for the extensor tendons, spanned by a transverse bridge which stands in the middle line, together with the form of the articular condyles, are all perfectly characteristic of the group. There are, however, a number of notable peculiarities. The most striking of these are the extreme length and slenderness of the shaft and the relative shortness of the fibular crest. In its general proportions the tibia of *Chenopsis*, particularly of the extinct New Zealand species *C. sumnerensis*, Forbes, seems to approach our fossil most nearly; on the other hand, there are some important differences, *e. g.* in *Chenopsis* the fibular crest is much longer, and in other parts of the skeleton the two birds are very dissimilar.

The distal end resembles that of the tibia of *Cygnus* in the width of its articulation, but differs from it and approximates to the type characteristic of the more terrestrial Geese in the very slight degree to which it is bent inward. Comparison of the tibia with those of a number of Geese shows that, while differing from them in the great length and relative slenderness of the shaft, it in many respects approaches those of *Chenalopex*, *Plectropterus*, and *Sarcidiornis*. The similarity to the tibia of the first named is very great, both in the form of the articular condyles and of the tibial bridge, but the distal extremity is somewhat more inflexed and its articulation wider than in *Chenalopex pugil*. The tibia of *Sarcidiornis* differs from our fossil in the greater depth and narrowness of its intercondylar groove. *Cereopsis* is also different, the characters indicating a terrestrial mode of life being in that genus more highly developed than in any other Anserine bird.

The dimensions (in millimetres) of the tibia are given on p. 346, those of the tibiæ of some other species being appended for comparison.

In size, proportions, and general structure the *femur* (Pl. VIII. fig. 3) is almost identical with that of *Plectropterus*, being much less massive and having a more clearly-defined

	<i>Centronis majori.</i>		<i>Chenopsis atrata.</i>	? <i>Chenopsis summerensis.</i>	<i>Cygnus olor.</i>	<i>Plectropterus gambensis.</i>	<i>Cereopsis novae-hollandiae.</i>	<i>Chenalopex aegyptiacus.</i>	<i>Chenalopex jubatus.</i>
Length (exclusive of cnemial crest).	213*	215	175	213	183	192	155	138	88
Width of upper articular surface	20 approx. 21		19	18	20	22	19	14	10
Width of middle of shaft	11.5	11	9	12	12	11	9	8	5
Thickness of shaft.	8.5	9	8	9	9	9	7	6.5	4
Width of distal extremity	21	20 approx.	20	24	24	21	18	15	9

* Type specimen.

neck than the femora of *Cygnus*, *Chenopsis*, or *Cereopsis*. Allowing for its smaller size, the femur of *Chenalopex aegyptiacus* is also similar, but has a somewhat straighter shaft and shallower groove between the head and the upper face of the trochanter. In *Sarcidiornis* the femur approaches the fossil still more closely, particularly in its slenderness and in the curvature of the shaft.

The degree of obliquity of the distal condyles, measured according to Milne-Edwards's method, is 69°.

The dimensions (in millimetres) of the femur, together with those of other Anserine birds, are as follows:—

	<i>Centronis majori.</i>		<i>Chenopsis summerensis.</i>	<i>Cygnus olor.</i>	<i>Plectropterus gambensis.</i>	<i>Cereopsis novae-hollandiae.</i>	<i>Chenalopex aegyptiacus.</i>	<i>Chenalopex pugil.</i>	<i>Sarcidiornis melanotos.</i>
Length	107	103	99	99	104	86	73	93	73
Width of proximal end.	26	25	27	27	26	24	18	..	16
Width of shaft	11	11	11	13	10	9.5	7	..	6
Width of distal end	26	27	26	27	23	17	..	15

Of the *metatarsus* (Pl. VIII. fig. 4), perhaps the most important bone for purposes of determination, only the distal

three-fourths of one specimen from the right leg and part of the shaft of another from the left are preserved. These bones belonged to the same individual, and are associated with portions of the tibia, coracoid, and other fragments, so that there is no difficulty in referring them with certainty to the present species.

Although about the proximal fourth is wanting, the specimen figured could easily be determined as Anserine, the form and size of the middle trochlea and its relation to the lateral ones being characteristic. Unfortunately the inner trochlea is broken away, but the position of its neck shows that it was reflected backward to a great extent. In comparison with the metatarsus of the Swans and those of most of the Geese, the bone is very long and slender, and its shaft is of a uniform thickness for a much greater part of its length. The metatarsi of *Plectropterus* and *Chenalopex ægyptiacus* present similar characters; this is especially the case with the latter, which, except that it is relatively shorter and has a rather longer outer trochlea, is strikingly similar. *Chenalopex pugil* has a much shorter and stouter metatarsus, and seems to differ also in some points in the form of the distal trochlea. In *Sarcidiornis* the metatarsus is very much shorter and stouter, and the shaft thickens much more rapidly towards its upper end.

The actual length of the fragment is 110 mm.; the length of the complete bone may be estimated at approximately 130 mm. The width of the middle of the shaft is 8·5 mm., that of the middle trochlea 10 mm.

The dimensions (in millimetres) of the metatarsi of some other Anserine birds are given below for comparison:—

	<i>Sarcidiornis melanotus.</i>	<i>Chenalopex pugil.</i>	<i>Chenalopex ægyptiacus.</i>	<i>Plectropterus gambensis.</i>
Length	71	120	86	130
Width of middle of shaft	7	? 8	6	10
Width of middle trochlea	6	? 8	6	11

The upper portion of a left *coracoid* belonging to the type is shown in Pl. VIII. fig. 5; other fragments of the bone also occur in the collection. The acrocoracoid is large and its neck short; on the inner surface, beneath the clavicular face, there is a deep pocket-like depression into which open pneumatic foramina. The clavicular process is short, and there is no subclavicular (supracoracoid) foramen. The bone, so far as known, is closely similar to those of *Plectropterus*, *Chenalopez*, and other Geese.

The proximal end of the typical *scapula* is figured on Pl. VIII. fig. 6, its outline being partly completed from a second, more perfect specimen, of rather larger size.

The acromium is large and prominent, as also is the coracoid facet. At the base of this latter, the outer surface of the bone is perforated by a pneumatic fossa; this also occurs in *Cereopsis*, *Anseranas*, and some species of *Anser*, but is wanting in *Sarcidiornis*, *Chenalopez*, and *Plectropterus*. The blade is broad and stout in proportion to the size of the head of the bone; unfortunately, even in the more perfect specimen the distal extremity has been broken away.

The following measurements of the coracoid and scapula may be useful:—

Coracoid: length from lower border of scapular facet to upper end of bone 31 mm.; width of glenoidal surface 13 mm.

Scapula: width of proximal end 23 mm.

The *sternum* is represented only by some small fragments.

Of the *humerus* only a few fragments remain: of these the most important are the greater portion of a shaft and a distal extremity. Judging from the former, the proportions of the whole bone resembled those of the humerus of *Plectropterus*, being much stouter than the humeri of *Sarcidiornis* and *Chenalopez*. The diameter of this shaft near the middle point is 13 mm. The distal extremity seems to have been relatively narrower and most like that of *Sarcidiornis*, except that the olecranon fossa is very shallow. The greatest width of this specimen is 30 mm.; it did not belong to the same individual as the shaft above mentioned.

A complete *radius* closely similar to that of *Chenalopez aegyptiacus*, but relatively a little more slender, is preserved.

The various grooves and muscle-attachments are rather better marked in the fossil than in the living form; this seems to be the case also in *Chenalopea pugil*. This specimen is 24 mm. in length. Compared with the radius of *Phænicopterus*, which in length it resembles, it is found to be much stouter and to differ in many other respects.

The proximal three-fourths of a right *ulna* wanting the olecranon process, and part of a left, correspond in size with the above-mentioned radius. They also agree closely in structure with the same bone in *Sarcidiornis* and *Chenalopea*, though, as might be expected, in the larger bird the muscle-impressions, particularly the insertion of the *brachialis anticus*, are more strongly marked. The largest diameter of the middle of the shaft is 10 mm.

Perhaps the most characteristic bone of this bird is the *metacarpus* (Pl. VIII. fig. 7), but unfortunately only the proximal half of that from the left side is preserved, and even from this the free portion of the third metacarpal is broken away. Its most striking character is the presence of a very long spur-like process formed by the production downward and forward of the fused first metacarpal. The terminal half of this process has an irregular roughened surface which indicates that it was not invested with a claw-like spur such as occurs in *Chauna* and some Plovers, but was most probably covered by rough hardened epidermis, like the similar processes in *Chenalopea* and *Sarcidiornis*. The resemblance of this bone to the metacarpus of *Chenalopea pugil* is remarkable, the only differences perceptible being that in this bird the spur is rather stouter and more curved forward; the size is nearly the same. The spur on the wing of *Plectropterus* is borne on a process of the radial carpal, and is therefore not comparable with that of *Chenalopea* and *Centronis*.

The dimensions of the imperfect metacarpal are :—

Greatest width of upper end.....	31 mm.
Length of spur measured from tip to middle point of articular surface for first phalangeal of digit I.....	26
Width of metacarpal II.	9

A specimen of the first phalangeal of the second digit, measuring 46 mm. in length, probably belonged to this bird.

It will be seen from the foregoing description that in *Centrornis majori* we have a Goose in many respects similar to *Sarcidiornis* and *Chenalopex*, but differing from them in its large size and in the great length of its legs. Indeed, judging from the slenderness of the metatarsus and femur and the slight degree to which the lower end of the long tibia is inflected, it seems probable that this bird was not a good swimmer, but was rather adapted for wading. The wings were long and powerful, and, being armed with a long spur, were no doubt formidable weapons.

The genus *Chenalopex* is represented by two species: *C. ægyptiacus*, inhabiting Africa and Palestine, and *C. jubatus*, found in South America. It is noteworthy that these birds are represented in the Pleistocene deposits of their respective areas by very large extinct forms, the former by *Centrornis majori*, the latter by the so-called *Chenalopex pugil**. These, though differing one from another in the form of their legs, seem to have been almost identical in the structure of their wings, the similarity between their metacarpi being a remarkable instance of parallel modification.

By far the greater number (at least three-fourths) of the bird-bones in the collection belong to another Anserine bird considerably smaller than that just described. Of this form all the important parts of the skeleton, including the skull, sternum, pelvis, and the bones of the fore and hind limbs, are preserved, and in one or two cases a number of bones are known to have belonged to a single individual. The largest of these associated sets includes the skull, two or three vertebræ, humerus, radius, ulna, scapula, and coracoid. The metatarsus is unfortunately wanting in this instance, but since several specimens occur associated with bones identical in form with those represented, it is possible to refer them

* I am of opinion that it would be not only justifiable but desirable to make this species the type of a new genus, since, though in very many respects similar to *Chenalopex jubatus*, it presents important differences both in size and structure.

with certainty to this species ; even if this method of identification had been impossible, the great number of specimens of this particular type of metatarsus would be strong evidence that they belonged to this, the commonest species.

If only the wing-bones had been preserved, this bird would probably have been regarded merely as a somewhat robust variety of *Sarcidiornis*, a genus now occurring in Madagascar. The skull and metatarsus, however, show that this is not the case, but that we are dealing with a bird closely allied to, if not identical with, the Egyptian Goose, *Chenalopex ægyptiacus*. This species is widely distributed in Africa, but has never been recorded from Madagascar so far as I can ascertain. Considering the great abundance of the fossil remains of this, or at least a closely allied species, in these comparatively recent deposits, the complete absence of such a bird from the present avifauna of the island is remarkable. It is also noteworthy that no bones that can be referred to *Sarcidiornis melanonotus*, now a common species, occur among the fossils, so that it seems that this species must be of late introduction and that it has succeeded in displacing the older *Chenalopex*-like type.

The various specimens which I refer to the present species indicate that it was subject to considerable variation in size, and that, as in *Chenalopex ægyptiacus*, the differences were partly dependent on sex, the male being larger than the female. Some of the measurements given below will show that this was the case.

It will be unnecessary to give a complete description of this species, but will be sufficient to point out the chief characters in which it differs from *Sarcidiornis melanonotus* and approaches *Chenalopex ægyptiacus*.

The *skull* (Plate IX. fig. 1). Of the skull of the type specimen the whole of the cranial region together with fragments of the facial portion are preserved. Comparison with the crania of *Sarcidiornis* and *Chenalopex* shows at once that the fossil differs widely from the former and approaches the latter in a number of structural points, the chief of which are : (1) the shortness of the postorbital part of the cranium ; (2) the narrowness of

the upper surface of the skull between the orbits—in *Sarcidiornis* this region is very broad; (3) the truncation of the superior and posterior margins of the orbits by glandular impressions. In all these points the fossil is identical with the skull of the Egyptian Goose, and in fact differs from it only in some minor points, such as the slightly greater prominence of the basi-temporal platform. The anterior portion of the skull is too broken for comparison.

The *sternum*.—Of the sternum no complete specimen is preserved, but several large portions show that in all important respects it is like that of *Chenalopex*, though certain small differences, such as the complete absence of a *spina externa* and the greater distance between the tuberosities for the attachment of the coraco-scapular ligament, occur. The first of these points seems, however, to be of little moment, since in one of two specimens of the sternum of *Sarcidiornis* the *spina externa* is large, in the other absent.

The *coracoid* is unlike that of *Chenalopex aegyptiacus* in several points. Thus the shaft immediately below the pre-coracoid process is narrower, and the acrocoracoid process is, in some cases at least, less massive, so that the whole bone has a more slender appearance than in the recent bird. The peculiar flattening of the anterior face of the bone seen in *Sarcidiornis* is here wanting. In one specimen there is a distinct supracoracoid foramen closed by a very delicate strip of bone.

The *scapula* and *furcula* present no important peculiarities. In the latter, however, the ventral border at the symphysis is produced into a slight angular projection instead of being evenly rounded as in *C. aegyptiacus*; this may, however, be merely an individual peculiarity.

The average length of the greater number of coracoids measured is about 67 mm., but a few occur which are 7 or 8 mm. longer. A specimen of the coracoid of *Chenalopex aegyptiacus* (sex unknown) measured 67 mm.

The *humerus* is very similar to that of *Chenalopex*. The tricipital fossa beneath the head is, however, much deeper than in *C. aegyptiacus*, in this respect approaching *C. pugil*.

The humerus of *Sarcidiornis* is at once distinguishable by the relatively greater length and slenderness of its shaft. Measurements of a considerable number of humeri show that they are separable into two groups, the average length of the bone in one being 147, in the other 132 mm. The larger bones are very few in number, while the smaller are very numerous; presumably the former belonged to the male birds, the latter to the females.

The *radius* agrees in structure with that of *Chenalopex aegyptiacus*, though some specimens seem more slender. In *Sarcidiornis*, on the other hand, this bone is very different, the whole distal third being expanded, instead of there being a sudden widening close to the extremity of the bone. In this respect *C. jubatus* somewhat resembles *Sarcidiornis*. The length of the smaller radii is about 126 mm., that of the larger about 134 mm. The extreme range of variation is between 125 and 135 mm. The length of this bone in *Chenalopex aegyptiacus* and *Sarcidiornis* is about 122 and 126 mm. respectively.

The *ulna* is essentially like that of *Sarcidiornis* and *Chenalopex aegyptiacus*, but in the smaller olecranon process and in the proportions of the shaft comes nearest the latter. The average length of the smaller (female) ulnæ is about 130 mm., that of the larger (male) 140 mm.; the extreme range of variation observed is between 129 and 142 mm. In *Chenalopex aegyptiacus* and *Sarcidiornis* the length of the ulnæ measured is about 129 and 133 mm. respectively.

The *metacarpus* (Pl. IX. fig. 2) agrees precisely with those of the skeletons of *Chenalopex aegyptiacus* with which I have been able to compare it; on the other hand, it differs widely from that of *Sarcidiornis*. For instance, the proximal articulation, looked at from the side, is larger and more rounded in outline, and the spur on metacarpal I. is curved forward, instead of pointing directly outward as in *Sarcidiornis*. Again, in our fossil the interosseous foramen is larger than in *Sarcidiornis*, owing to the second and third metacarpals being less extensively fused at their distal extremities.

It may be remarked that the metacarpus figured by Newton

and Gadow (Trans. Zool. Soc. vol. xiii. pl. xxxiv. figs. 9 & 10), as the type specimen upon which the species *Sarcidiornis mauritanus* is founded, is indistinguishable from some of these Malagasy specimens, and therefore is also entirely unlike the metacarpus of *Sarcidiornis*: it really belonged to a species of *Chenalopex*, which may or may not be distinct from that under description. As in the case of the other bones of the skeleton, the specimens of the metacarpus fall into two groups, in one of which they average about 85 mm. in length, in the other about 76 mm.; these latter are the more numerous. In the larger specimens the spur is relatively larger, and these, no doubt, belong to the male birds.

The length of the type metatarsus of *Sarcidiornis mauritanus* is about 77 mm., that of a specimen of *C. aegyptiacus* 80 mm.

The *pelvis* differs widely from that of *Sarcidiornis*, and approaches that of *Chenalopex aegyptiacus* in many points; thus the whole post-acetabular region is wider, and, seen from below, shallower than in the former genus, and the centre of the urosacral vertebræ are wider and their transverse processes more prominent and separated by deeper fossæ. The greater width of the post-acetabular region is chiefly due to the expansion of the hinder portion of the ilia. In one specimen the ischiadic foramina are smaller than in the pelvis of *C. aegyptiacus*, with which I have compared it, but it appears that this is merely due to the extension of ossification in the connective tissue which closed the opening consequent upon age. The pectineal process is much more prominent in the fossil than in the recent form, and there are some slight differences in the fenestration of the sacral region.

The *femur*, the length of which is the same as those of *Sarcidiornis* and *Chenalopex aegyptiacus*, with which it was compared, differs from the former in being much stouter in the shaft and in possessing more massive articular ends; from the latter the main point of difference is the stouter shaft.

The *tibio-tarsus* is practically identical in form with that of *Chenalopex aegyptiacus*. It is in the *metatarsus* (Pl. IX. fig. 3) that the likeness to *Chenalopex* and the difference from *Sarcidiornis* of the present species are most marked. In the former this bone is relatively long and the shaft is slender in proportion to the width of the articular extremities; moreover, the inner trochlea is less backwardly directed than is usually the case in the members of the group that are good swimmers, and, in fact, the whole bone indicates that the bird is a good walker. In *Sarcidiornis*, on the other hand, the metatarsus is relatively short, the shaft square and thick in proportion to the articular ends, while the inner trochlea is strongly reflected backward, the whole indicating that this bird is a powerful swimmer. The fossil metatarsi are almost identical with those of *Chenalopex aegyptiacus*, the only difference being that the extremities are a trifle narrower in proportion to the length of the bone, and in some cases the muscle-impressions are more strongly developed. The length varies from 87 to 95 mm.; in *Sarcidiornis* the length is from 67 to 71 mm., in *Chenalopex aegyptiacus* about 85 mm.

The numerous slight differences between the skeleton of the fossil and that of *Chenalopex aegyptiacus* appear to be sufficient to justify us in regarding it as a distinct species, for which the name *Chenalopex sirabensis* may be adopted. It is, however, possible that when further remains of the bird described by Newton and Gadow as *Sarcidiornis mauritianus* are discovered it may prove to be the same.

There are also a number of bones of smaller Anserine birds. Of these the greater number belong to *Anas melleri*, or to a species which cannot be distinguished from it by any characters in the remains preserved. These include humeri, a coracoid, an ulna, and some metacarpi. The length of the humeri ranges from 86 to 90 mm.; in a recent specimen the length is 88 mm.

There are also several bones of smaller Ducks. Of these a left femur seems to belong to *Anas erythrorhyncha*; the others cannot at present be determined, owing to the want of skeletons of the recent species for comparison.

One of the most notable specimens in the collection is an imperfect Ralline pelvis, which cannot be referred to any species now living in the island, but which is closely similar to that of *Tribonyx mortieri*, Gould, now living in Australia and Tasmania. This specimen was found in the superficial black earth.

This *pelvis* (Pl. IX. figs. 4 & 5) of this bird exhibits typically Ralline characters in the forms of the pelvic escutcheon and of the posterior renal fossæ. From the pelves of *Porphyrio*, *Ocydromus*, and other Ocydromine Rails (e. g. *Aphanapteryx*, *Diaphorapteryx*, and *Erythromachus*) it is at once distinguished by the fact that the ilia in the pre-acetabular region do not unite with the summit of the neural spines of the sacral vertebræ throughout their whole extent, but, as in *Fulica* and *Gallinula*, in their middle portion the dorsal borders curve down so as to leave the spines in that region laterally exposed. From the pelvis of *Porphyrio* the fossil is further distinguished by the concavity from side to side of the dorsal surface of the post-acetabular sacrum, and by the relatively greater width of the posterior renal fossæ. In *Ocydromus* the whole of the posterior half of the pelvis is narrower. In *Fulica* and *Gallinula* the length of the pelvis in proportion to its width is much greater. On the other hand, the points of difference from the pelvis of *Tribonyx* are trifling, the only noticeable ones being the rather greater width of the pelvic escutcheon, and, in correlation with this, the wider posterior renal fossæ, and the smaller size of the supra-acetabular ridges of the ilia. In the Australian bird, moreover, there is a rather deep depression in the ilia immediately in front of the acetabulum and above the pectineal process; this depression is wanting in the fossil.

There is no doubt that this bird is generically distinct from any form now found in Madagascar, but the similarity to the Australian *Tribonyx* is so great that it may be provisionally referred to that genus, though very probably, when the skeleton has become better known, it may prove to be distinct. The specific name *Tribonyx roberti* may be adopted for it.

The dimensions of the pelvis, together with those of *Tribonyx mortieri* and some other Rails, are as follows:—

	? <i>Tribonyx roberti</i> .	<i>Tribonyx mortieri</i> .	<i>Ocydromus</i>	<i>Porphyrio melanonotus</i> .
	mm.	mm.	mm.	mm.
Length of ilium	82 approx.	89	82	78
Least width of pre-acetabular region of pelvis	14	15	13	13
Width at antitrochanter	40	38	34	34
Width at anterior angle of pelvic escutcheon	36	34	32	31
Width at posterior angle of ditto	40	39	37	37
Length of sacrum	68	70	65	63

A beautifully-preserved left *tibia* (Pl. IX. fig. 6) possibly belongs to this species, since it is closely similar to that of *Tribonyx mortieri*. It differs, however, in the following points:—(1) The intercondylar groove is a little wider and shallower; (2) the inner condyle is less massive, so that the difference between the inner and outer condyles is more marked than in the Australian bird; (3) the shaft immediately above the extensor bridge is wider, and the bridge itself less oblique; (4) the fibular crest is relatively longer. It also, in most respects, resembles the tibia of *Porphyrio*, but is distinguished from it by the relatively larger size of the articular ends, the more marked inflection of the distal one, and the fibular crest is longer. The tibia of *Ocydromus* is much stouter and has a less incurved distal end than the fossil, which, in this respect, as well as in some other points, closely approaches the Fulicine type.

The dimensions of this tibia and of those of some other Rails are given below:—

	? <i>Tribonyx roberti</i> .	<i>Tribonyx mortieri</i> .	<i>Porphyrio melanonotus</i> .	<i>Ocydromus australis</i> .
	mm.	mm.	mm.	mm.
Length	143	135	145	121
Width at lower end . .	12	14	12	13
Width at middle of shaft	7	8	6	6

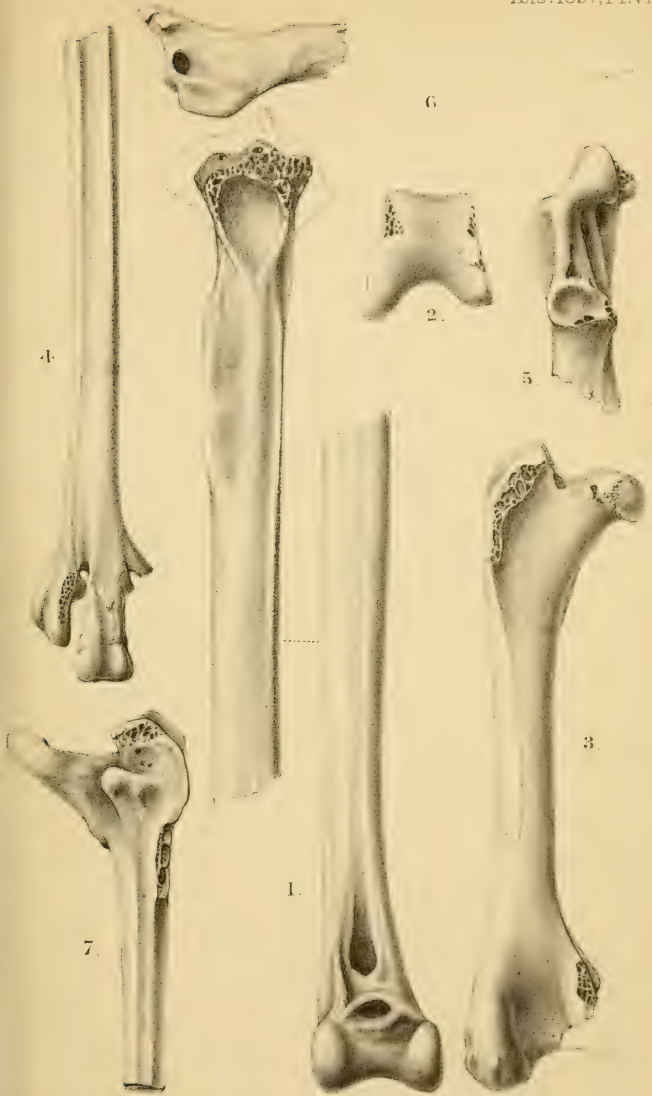
There is also a complete right *femur* (Pl. IX. fig. 7), which exhibits the usual peculiarities of that bone in the Rails. This may, perhaps, belong to the present species, but indicates an individual rather larger than that to which the pelvis belongs. The shaft is much more curved than in *Porphyrio*, and the extremities are more massive. The dimensions of this femur are:—

	? <i>Tribonyx</i> <i>roberti</i> .	<i>Tribonyx</i> <i>mortieri</i> .	<i>Ocydromus</i> <i>australis</i> .	<i>Porphyrio</i> <i>melanonotus</i> .
Length	mm. 83	mm. 85	mm. 74	mm. 76
Width of lower end..	17	18	15	14
Width of shaft at middle	7	8	6	5.5

In addition to the above-described specimens, there are a number of odd bones, of which, in most cases, it is impossible to do more than determine the genus, at least until a more complete series of skeletons of Malagasy birds shall be available for comparison.

Among these bones are included a right humerus of *Ardea intermedia*; a right tibia of a Spoonbill, probably *Platalea tenuirostris*, Temminck; a left tibia of a Hawk, probably belonging to the genus *Astur*; its length is 97 mm., so that the bird was apparently about the same size as the male of *A. hensti*, Schlegel. Lastly, there is the proximal half of a left humerus (Pl. IX. fig. 8) of a very small species of *Plotus*. This specimen agrees closely with the humerus figured and described by Newton and Gadow (*loc. cit.* pl. xxiv. figs. 3-4) as one of the type specimens of *Plotus nanus*, and it must be referred to that species.

In conclusion, it may be remarked that the very large collection of bird-remains here described, together with great quantities of bones of *Æpyornis*, and also of various mammals, including an ape-like form (*Nesopithecus*) new to science, was obtained under circumstances of great difficulty and danger. The swampy nature of the deposits made the





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Mintern Bros. imp.

Figs 1-3. *Chenalopex sirabensis*. Figs. 4-7. *Tribonyx roberti*.

Fig 8. *Plotus nanus*

task of excavating very arduous, and the work was frequently interrupted for days at a time through the growing hostility of the natives. Dr. Forsyth Major and his companion, M. Robert, are therefore the more to be congratulated that, under such unfavourable conditions, they have added so much to our knowledge of the extinct fauna of Central Madagascar.

EXPLANATION OF THE PLATES.

PLATE VIII.

Remains of *Centronis majori* (p. 344).

- Fig. 1. Right tibio-tarsus, from front (figured in two halves).
2. Right tibio-tarsus, distal articulation.
3. Right femur, from front.
4. Right metatarsus, from front.
5. Left coracoid, upper end.
6. Left scapula.
7. Right metacarpus, proximal portion.

All the figures are of the natural size, and, with the exception of the metatarsus, are drawn from the type specimens. The dotted outlines are drawn from more perfect bones.

PLATE IX.

- Fig. 1. Skull of *Chenalopex sirabensis* (p. 355).
2. Metacarpus of ditto.
3. Metatarsus of ditto.
4. *Tribonyx roberti* (p. 356). Pelvis, from above.
5. Ditto. Pelvis, from side.
6. ? Ditto. Left tibio-tarsus.
7. ? Ditto. Left femur.
8. *Plotus nanus* (p. 358). Left humerus.

All the figures are of the natural size. In figs. 4 and 5 the dotted outlines are drawn from the opposite side.

XXVII.—*On Changes of Plumage in some of the Typical Weaver-birds.* By A. G. BUTLER, Ph.D.

ABOUT the year 1888 I purchased two pairs of the so-called Red-billed Weaver-bird (*Quelea quelea*) and a male of Russ's Weaver (*Quelea russi*), and turned them out together in one